

Instructions: Put your name, PID, section number, and TA's name on your blue book. No calculators or electronic devices are allowed. Turn off and put away your cell phone. You may use one page of handwritten notes, but no other resources. Make sure your solutions are clear and legible. **Show all of your work.** Credit will not be given for unreadable or unsupported answers. Please keep the questions in order in your blue book and clearly indicate which problem is on which page.

1. (9 points) Let the rational function $r(x)$ be defined by

$$r(x) = \frac{2x^2 + 3x + 6}{x^2 - 4x - 5}$$

- (a) (3 pts) Find the domain of $r(x)$.
- (b) (2 pts) Find the horizontal asymptote of $r(x)$ if it exists. If not, state that it does not exist.
- (c) (4 pts) By polynomial long division (or any other method you want), write $r(x)$ in the form

$$A + \frac{Bx + C}{x^2 - 4x - 5}$$

where A , B , and C are real numbers.

2. (6 points) Solve the equation for x :

$$\log_4(x+1) + \log_4(x-2) = 1$$

(i.e. find all real x that satisfy the equation)

3. (7 points) Suppose u and v are two numbers such that

$$\log_3(u) = 6.3 \quad \text{and} \quad \log_3(v) = 2.5$$

Find:

- (a) (2 pts) $\log_3\left(\frac{u^2}{v}\right)$
- (b) (3 pts) $\log_9(u^2)$
- (c) (2 pts) $\log_3(v\sqrt[3]{u})$

4. (5 points) Suppose a bacteria culture initially has a population of 100 cells and also suppose that it doubles in population every 2 hours. How much time will pass before the population reaches 1400 cells?

(Your answer may or may not be an integer and your answer may include logs or exponents- That is expected because you do not have a calculator)

5. (7 points) Solve the system of equations:

$$x + 2e^y = 5$$

$$2x + e^y = 4$$

(i.e. find all pairs (x, y) that satisfy both equations).

6. (6 points) Suppose for a snack you have some strawberries and cherries. Each strawberry has 4 Calories and each cherry has 5 Calories. Suppose the snack has a total of 116 Calories and that you have 25 pieces of fruit. How many fruits of each kind do you have?